## REMARKS

Claims 1 - 20 are in this application and are presented for consideration. By this Amendment, Applicant has made minor formal changes to the original claims. Additionally, new claims 17 - 20 have been added. New independent claim 17 is similar in scope to claim 9 but presents a subject matter in a different format. New claims 18 - 20 are similar to claims that depend on claim 9.

The abstract of the disclosure has been objected to. Applicant attaches a new abstract which overcomes the objections raised.

Claim 15 has been objected to. Applicant has made changes to this claim to address the issues that have been raised.

Claims 1 - 16 have been rejected as being anticipated by Huang et al. (Construction and Soccer Dynamics Analysis for an Integrated Multi-Agent Soccer Robot System, 2001). Applicant respectfully traverses the rejection as the reference does not teach each process or system feature interrelated as specified in the claims. Applicant requests that the Examiner consider the following and reconsider the rejections as now stated. Further, favorable consideration of the new claims is requested.

The invention of the present application presents a different approach from the article, "*Construction and Soccer Dynamics Analysis of an Integrated Multi-agent Soccer Robot System*" (Huang et al.). The differences form the basis for the claims of the present application.

At the background of these developments are many examples of systems including a

plurality of robots working together. Already cited is an industrial example (the body of the application text cites US 6330493Bl) as a typical example. The subject of the present application is the method by which these robots are calibrated with respect to each other. Calibration is explained as the ability for any one robot, when given the current position of another robot, to accurately transform that position to a set of coordinates understood by the one robot.

The method in US 6330493Bl (a standard method) assumes that for a given position of the one robot, a single calibration transformation may be used for any position of the other robot. It is believed that the situation represented by the soccer robot system cited in the office action is similar to that of US 6330493B1. As explained in the specification this approach is insufficient in real practice. As such, the present invention is an improvement, and is not anticipated by the prior art.

The basic reason that the academic approach is insufficient is that the robots themselves, when used as a measurement system, use an ideal model of the robot when transforming from the robot's measurement devices to the measured position. The difference between ideal and non-ideal is a non-linear model with respect to the position of the robot in its workspace. For many applications, one can ignore this small difference between ideal and non-ideal. But in industrial application in particular, the disclosed and claimed improvement of the present invention achieves improvements to sub millimeter requirements.

In the Huang et al. with the robot system pertaining to the soccer robots, there is no

mention of how calibration is done between the vision measurement system and the field of objects that it measures. The field includes the robots and the soccer ball. One can therefore not assume anything about the mapping linear or non- linear, between the vision measurement system and the applied coordinate system. It would be quite typical in such a system to use a single calibration transformation from the vision measurements to the applied coordinates for every robot and for the ball on the field. This would imply limited accuracy of the system, and there is no mention in Huang et al. of any method used to improve such accuracy. Huang et al. does not anticipate the claimed features and the solution to this problem is not suggested by Huang et al.

Further, in such a system, none of the robots are aware of their own position nor the position of any other robot. This indicates that Huang et al. cannot teach the features of the invention, that rely on such knowledge. There is only one measurement system in Huang et al., the vision system, keeping track of the position of all robots and the ball. As such, there is no issue of transforming the position as measured by one robot to the coordinate system of another robot. There is only one measurement coordinate system and one application coordinate system for all objects.

The basis of the rejection of claims 1 and 9 is detailed in the Office Action at page 3 with particular reference to coordinate transformations and memory. However, Huang et al. does not teach each and every feature as required by these claims.

The system taught by Huang et al. does not directly calibrate one robot with respect to another, because the robots do not contain their own measurement systems. The vision system

is the only means of measurement for all robots. The vision system must be calibrated to the soccer field. Subsequently, during use, the Huang et al. system uses object recognition to determine the location and velocity of the objects on the field. With this method, at most a single transform can be calculated from one robot (1) to another robot (2) for any given pair of positions of the two robots. The transformation from another robot (2) to the first robot (1) is necessarily the exact inverse of the first transformation. The basis of the claimed invention is that each robot has its own measurement system, and each robot's measurement of its position in the work envelope (zone) is different from the ideal in a non-linear way. Therefore the transformation from the first robot to a second is not the exact inverse of the transformation from the second to the first.

With regard to claim 2, the rejection (see page 4) takes the position that Huang et al. teaches calibration of the robots relative to each other with the relative calibration relating to an independent robot. However, it appears that Huang et al. does not go into any details as to calibration. It appears that the only calibration relates to the main control or vision system. The soccer robot system does use multiple robots, but as stated previously, these robots are not calibrated to one another such that each has an independent transformation to each of the others.

As to claim 3, the rejection takes the position that Huang et al. teaches several calibrations performed for each different position for each robot.

The robots of the Huang et al. system move, but they are not calibrated (measured) in different positions. There is only one calibration between the vision system and the field, used

for ALL positions of the robots in the field. Claim 3 involves calibration between robots with this being done in different regions (plural regions). Multiple regions between 2 robots have different transformation for each region. This is due to the fact that robots do the measurements, and the robots have mechanical inaccuracies. Therefore, Huang et al. does not teach a method for doing different calibrations at different positions. In fact, it should be noted that Huang et al. does not teach any method of calibration at all.

Claim 4 relates to the invention wherein calibrations are performed in multiple positions between the plural robots and wherein transformations are formulated based on the calibrations, based on the measurements. The rejection takes the position that Huang et al. discloses calibrations for each robot performed in different positions. However, it does not appear that Huang discloses the measurements and formation of transforms as claimed.

Again, the solution of Huang et al. is based on a single transform based on the world (with reference point and directions for transformation) described by the camera transform. Transforms between soccer robots and the ball are based solely on this frame. The objects are in different positions on the 2 dimensional field, but the transformation from vision to the application coordinates is not calibrated at different positions. Again, Huang et al. teaches no method of calibrating the vision system to the field at all. The invention involves calibration with robot measurement.

The rejection of claim 5 is based on the position that Huang et al. teaches cooperative operation with an independent and dependent robot relationship. It is Applicant's position that this is not disclosed in Huang.

Claim 5 relates to the transformation from robot 2 to robot 1 as applied to the coordinates of robot 1 so that robot 2 may perform a cooperative operation relative to robot 1. Huang et al. uses a vision system to determine the transformation between the robots on the soccer field. This transformation does allow for inaccuracies specific to the robots in use. The host computer receives data as to the motion (motion signal) of the soccer robots. It is the host computer that knows all transformations. Claim 1 is directed to transformations that are stored in separate memories associated with separate control devices of different physical units.

Claim 6 is rejected based on the position (see page 4 bottom of page) that Huang et al. teaches a method wherein work operation occurs in a dependent manner.

The robots of Huang et al. move, but they are not calibrated (moved with measured position detection) in different positions (moved with measured position detection). There is only one calibration between the vision system and the field, used for ALL positions of the robots in the field. Claim is directed to the calibration between robots (base claims) that is executed in different regions. Multiple regions between two robots have different transformations. This is different forces acting on the robots in different zones of action. The robots do the measurement – provide the calibration – and the robots have mechanical inaccuracies. Huang et al. does not teach a method for doing different calibrations at the robot and at different positions. Huang et al. does not teach any method of calibration and directs the person of ordinary skill in the art away from the calibration and transform system and method claimed.

Claim 7 has been rejected based on the position that Huang et al. teaches the method

wherein there is cooperative operation between robots with an independent dependent relationship of operation.

The Huang et al. solution does not rely on spatially independent or dependent robots. All are controlled from a central host PC. One robot's operation is not dependent on another's position, but commanded by the host computer.

Claim 8 has been rejected based on the position that Huang et al. discloses a change over from the independent dependent relationship of robots. It is Applicant's position that claim 8 can be understood with regard to the dependent/independent relationship described in the specification and clear from the claim. Specifically, spacial position dependency of the robot relates to a dependent robot moving based on the movement of the independent robot. This is cooperative movement. Namely, when an independent robot moves, the dependent robot, whose movement is depended on the independent robot, also moves.

The teachings of Huang et al. do not present a suggestion with regard to a spacial independent or dependent robot system. Instead, the various robots move differently and these are coordinated from a host computer. There is no independent/dependent relationship. Instead, these robots are all independent but directed or choreographed by the central control. The operation of one robot is not directly dependent on another and the host computer structures the workings of the robots based on the workings of the game and the movement of the ball. As such, Huang does not teach the concept of spacial dependency. Huang does not teach a switch over of the dependency of the plural robots wherein this has a consequence as to the related calibration and transforms.

Claim 10 has been rejected based on the position that Huang et al. teaches a system with plural robots wherein these have transforms relative to each other.

The solution of Huang et al. does have a memory means to store transformations in the host PC. It is the host computer that knows all transforms. Claim 9 highlights that the transforms are stored in separate control devices. Furthermore, the soccer robot solution uses a vision system to determine the transformation between the robots on the soccer field,. This transformation does allow for inaccuracies specific to the robots in use.

Claims 11 - 12 have been rejected based on the position that the calibration of each robot is taught by Huang et al. where several transformations are provided and stored as claimed. However, it is Applicant's position that each feature is not disclosed by Huang et al..

The robots in Huang et al. are not calibrated (measured) in different positions. There is only one calibration between the vision system and the field, used for all positions of the robots on the field. Claims 11 - 12 are directed to the calibration between robots with this measurement of position being done in different regions. Multiple regions between two robots have different transformations for each region. The invention provides the multiple calibrations and the related transformations. This is related to the robots doing the measurements, and the robots having mechanical inaccuracies. Therefore, Huang et al. does not teach a method for doing different calibrations and the related transformations at different positions. Huang et al. does not disclose calibrations and does not teach or suggest the claimed features.

The rejection of claims based on Huang et al. is based on the position that it teaches a system with the use of coordinates of an independent robot and transform coordinates relative

to the dependent robot. It is Applicant's position that these features are neither taught nor suggested as required by the claim. The terms "dependent" and "independent" have meaning in the claims. Huang et al. does not suggest such a relationship and does not suggest the use of transforms as claimed. The claims and application refer to the "spatial position dependency" of one robot to the other (When an independent robot moves, the dependent one follows exactly).

Claim 1 defines the transformation from robot 2 to robot 1 as applied to the coordinates of robot 1 so that robot 2 may perform a cooperative operation relative to robot 1. The Huang et al. system uses a vision system to determine the transformation between the robots on the soccer field. This transformation does allow for inaccuracies with respect to the robots in use. Furthermore, the host computer sends the motion signal to the soccer robots. It is the host computer that knows all transforms. With the invention, different transforms are stored at different robots, separate control devices.

Claim 14 has been rejected based on the position that Huang teaches a system using coordinates of one robot and coordinates of the other robot transform relative thereto with the transforms relating to different areas of operation. It is Applicant's position that this is not taught and not disclosed by Huang et al..

The robots in Huang et al. move, but they are not calibrated (measured) in different positions. There is only one calibration between the vision system and the field, used for ALL positions of the robots in the field. Claim is directed to the calibration between robots (base claims) that is executed in different regions. Multiple regions between two robots have different

transformations. This is different forces acting on the robots in different zones of action. The robots do the measurement – provide the calibration – and the robots have mechanical inaccuracies. Huang et al. does not teach a method for doing different calibrations at the robot and at different positions. Huang et al. does not teach any method of calibration and directs the person of ordinary skill in the art away from the calibration and transform system and method claimed.

Claims 15 - 16 have been rejected based on the position that Huang discloses a chooseable or selectable use of robot as an independent and dependent robot, namely a dependant robot with spacial position following the independent robot movements.

The Huang et al. solution does not rely on spatially independent or dependent robots. All robots of Huang et al. are controlled from a host PC. One robot's operation is not directly dependent on another's position. Instead according to Huang et al. commands are sent from the host computer based on a logical dependency of the game. Since in Huang et al. , there is no concept of spatial dependency, Huang et al. does not teach how such dependency might be changed or the consequence of such change as dated to calibration.

The reference fails to teach and fails to suggest important aspects of the invention. The features are important in providing a different approach with regard to control of plural robots, particularly industrial robots engaged in cooperative operation. As the reference directs the person of ordinary skill in the art toward a centrally controlled system, with plural robots coordinated through the central control, the reference fails to suggest the calibration and transformation forming system and process claimed. As such, Applicant respectfully requests

that the Examiner reconsider the rejection and favorably consider the claims as presented.

Respectfully submitted
for Applicant,

By: _____
John James McGlew
Registration No. 31,903
McGLEW AND TUTTLE, P.C.

JJM:jj/tf
71058.9
Enclosed: Abstract of the Disclosure

DATED: June 10, 2005
BOX 9227 SCARBOROUGH STATION
SCARBOROUGH, NEW YORK 10510-9227
(914) 941-5600

SHOULD ANY OTHER FEE BE REQUIRED, THE PATENT AND TRADEMARK OFFICE IS HEREBY REQUESTED TO CHARGE SUCH FEE TO OUR DEPOSIT ACCOUNT 13-0410.